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AMIS0099

Certified Reference Material

Platinum (PGM) Merensky Reef Ore Bushveld Complex, South Africa

Certificate of Analysis

Recommended Concentrations and two “Between Laboratory” Standard Deviations

Certified Concentrations

Pd NIS	0.231	±	0.024	g/t
Pt NIS	0.565	±	0.060	g/t
Pt Pb Collection	0.59	±	0.07	g/t
Co P	12.7	±	1.4	ppm
Cu M/ICP	256	±	18	ppm
Cu P	250	±	15	ppm
Ni M/ICP	443	±	48	ppm
Ni P	362	±	23	ppm
Ni XRF	427	±	44	ppm
Specific Gravity	2.75	±	0.12	

Provisional Concentrations

Pd Pb Collection	0.225	±	0.034	g/t
Au Pb Collection	0.089	±	0.016	g/t
Au NIS	0.085	±	0.022	g/t
Ir NiS	0.01	±	0.002	g/t
Rh NiS	0.029	±	0.004	g/t
Ru NiS	0.06	±	0.010	g/t
Co M/ICP	23.1	±	4.1	ppm
Cr XRF	1628	±	280	ppm

$$4E = 0.961 \text{ g/t}$$

Major Element Recommended Concentrations and two “Between Laboratory” Standard Deviations

Certified Concentrations

Al ₂ O ₃	2.1	±	0.05	%
CaO	1.11	±	0.04	%
Cr ₂ O ₃	0.24	±	0.01	%
Fe ₂ O ₃	3.15	±	0.08	%
K ₂ O	0.12	±	0.01	%
MgO	3.38	±	0.24	%
MnO	0.12	±	0.002	%
SiO ₂	89.20	±	0.64	%

Provisional Concentration

Na ₂ O	0.17	±	0.05	%
TiO ₂	0.072	±	0.012	%

Informational Mean

LOI	0.21	%
P ₂ O ₅	0.015	%

1. Intended Use: AMIS0099 is a certified reference material which may be used to demonstrate the validity of measurement results of a single analysis of tails or low grade PGE, Cu and Ni ores, hosted by the Merensky Reef or other mafic rocks, with a similar grade and matrix; when measured in parallel to the unknown to be characterised. The material can be used for routine quality control by inserting within a batch of samples, for method development and for the calibration of equipment.

The recommended mean and "Between Lab" standard deviations for this material property values based on a measurement campaign (round robin) and reflect the average results from the laboratories that participated in the round robin, after examination of the data set and removal of technically and statistically invalid results (see Clause 9 - this certificate). Slight variations in analytical procedures between laboratories will reflect as slight biases to the recommended concentrations and this is acceptable. Good laboratories however will report results within the two standard deviation levels with a failure of <10 %.

2. Origin of Material: This standard was made using Merensky Reef Pt/Pd ore material supplied by Anglo Platinum Limited from the Western limb of the Bushveld Complex. This specific material is a blend of ore collected from the Turfontein Mine ore silo and footwall material collected from the Boschfontein Shaft that has been further blended down with blank silica.

3. Mineral and Chemical Composition: The Merensky Reef comprises components of feldspathic pyroxenite, pyroxenite and anorthosite. Peak PGE values are associated with a thin chromitite stringer. Mineralization in this Merensky Reef comprises 2-5% disseminated or net textured magmatic sulphides, predominantly pyrrhotite, pentlandite, chalcopyrite and pyrite. The PGE's occur as micron-sized satellite grains around but rarely within the sulphides.

Major element chemistry data from 12 of the labs has been compiled and certified. Uncertified summary statistics for trace element data are set out in the appendix.

4. Appearance: The material is a very fine powder. It is colored a Yellowish Grey (Corstor 5Y 8/2).

5. Handling instructions: The material is packaged in Laboratory Packs and Explorer Packs that must be shaken or otherwise agitated before use. Normal safety precautions for handling fine particulate matter are suggested, such as the use of safety glasses, breathing protection, gloves and a laboratory coat.

6. Method of Preparation: The material was crushed, dry-milled and air-classified to <54µm. Wet sieve particle size analysis of random samples confirmed the material was 98.5% <54µm. It was then blended in a bi-conical mixer, systematically divided and then sealed into 1kg Laboratory Packs. Explorer Packs are subdivided from the Laboratory packs as required. Samples were randomly selected for homogeneity testing and third party analysis. Statistical tests were carried out for homogeneity and the consensus results.

7. Methods of Analysis requested:

1. Pt, Pd and Au. ICP-OES or ICP-MS, Pb collection with Ag as a co-collector.
2. Au, Pt, Pd, Rh, Ru and Ir. ICP-MS, nickel sulphide collection.
3. Cu and Ni. Multi-acid total digestion, including HF, with ICP-OES finish.
4. Cu and Ni. Aqua regia digestion with ICP-OES finish.
5. Cr, Co, Cu and Ni. Pressed pellet XRF.
6. Cr, Co, Cu and Ni. Fusion, ICP-OES or ICP-MS
7. Specific Gravity. Gas pycnometer.
8. XRF (major elements).
9. Multi acid digest ICP scan – trace elements.

8. Information requested:

1. Aliquots used for all determinations.
2. Results for individual PGM's reported in ppb.
3. Results for base metals reported in ppm.
4. QC data, to include replicates, blanks and certified reference materials used.
5. Analytical techniques used.

9. Method of Certification: Thirty one laboratories were each given eight randomly selected packages of sample. Twenty three of the laboratories submitted results.

The final limits were calculated after a three step examination of the data, first removing incompatible data outside a spread normally expected for similar analytical methods done by reputable laboratories. Then, data from any one laboratory was removed from further calculations, if the mean of all analyses from that laboratory failed a t-test of the global means of the other laboratories. Next, data that fell outside of the 2 standard deviations were removed. The mean and standard deviations were then re-calculated.

Analytes with an RSD of near or less than 5 % are reported as "Certified Concentrations" with limits at two "Between Laboratory" standard deviations. Those with RSD's of between near 5 % and 15 % are reported as "Provisional Concentrations" with limits at two "Between Laboratory" standard deviations. Those with RSD's over 15 % are reported as "Informational Values".

This method is different from that used by Government agencies in that the actual "between-laboratory" standard deviation is used in the calculations. This produces upper and lower limits that reflect actual individual analyses rather than a grouped set of analyses. The limits can therefore be used to monitor accuracy from individual analyses, unlike the Confidence Limits published on other standards.

10. Participating Laboratories: The 23 laboratories that provided results timeously were (not in same order as in the table of assays):

1. ACME Analytical Laboratories Ltd CA
2. Activation Laboratories Pty Ltd (ActLabs) CA
3. ALS Chemex Laboratory Group Johannesburg SA
4. ALS Chemex Laboratory Group Perth WA
5. ALS Chemex Laboratory Group Vancouver CA
6. Ammtec Limited WA
7. Anglo Platinum - Eastern Bushveld Regional Laboratory
8. Anglo Research (Crown Campus)
9. Assayers Canada
10. Barplats Laboratory SA
11. Becquerel Laboratories Inc CA
12. Genalysis Laboratory Services (South Africa) Pty
13. Genalysis Laboratory Services WA
14. Intertek Testing Services Ltd Shanghai (ITS Beijing)
15. Intertek Utama Services (Indonesia)
16. Labtium Inc Finland
17. OMAC Laboratories Limited (Ireland)
18. Set Point Laboratories (Isando) SA
19. Set Point Laboratories (Mokopane) SA
20. SGS Australia Pty Ltd (Newburn) WA
21. SGS Lakefield Research Africa Pty Ltd (Booyens) SA
22. SGS Mineral Services Lakefield (Canada)
23. Ultra Trace (Pty) Ltd WA

11. Assay Data: Data as received from the laboratories for the important certified elements listed on p1 are set out below.

Lab Code	Au NIS g/t	Ir NIS g/t	Pd NIS g/t	Pt NIS g/t	Rh NIS g/t	Ru NIS g/t	Au Pb Col g/t	Pd Pb Col g/t	Pt Pb Col g/t	Co M/ICP ppm	Co P ppm	Co XRF ppm	Cr M/ICP ppm	Cr XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG	
A	0.07	0.01	0.24	0.54	0.03	0.06	0.07	0.24	0.54	21.3	18.0	23.0		1520	243	236	240	434	415	456	2.67	
A	0.06	0.01	0.25	0.55	0.03	0.06	0.07	0.25	0.54	21.7	16.0	22.0		1530	247	243	240	450	423	452	2.68	
A	0.06	0.01	0.25	0.55	0.03	0.06	0.07	0.25	0.54	22.5	16.0	22.0		1520	251	245	240	453	416	449	2.67	
A	0.07	0.01	0.25	0.54	0.03	0.07	0.06	0.25	0.54	22.6	17.0	22.0		1520	244	241	237	465	420	452	2.67	
A	0.07	0.01	0.24	0.54	0.03	0.07	0.07	0.24	0.54	22.5	17.0	21.0		1490	244	235	233	460	415	443	2.67	
A	0.07	0.01	0.24	0.54	0.03	0.06	0.07	0.25	0.55	22.8	17.0	22.0		1530	248	228	236	460	401	450	2.65	
A	0.07	0.01	0.24	0.55	0.03	0.06	0.07	0.24	0.55	22.6	18.0	21.0		1490	248	236	231	452	420	440	2.65	
A	0.06	0.01	0.24	0.53	0.03	0.07	0.06	0.25	0.55	23.6	16.0	22.0		1500	250	232	234	461	412	440	2.68	
B								0.17	0.23	0.56	27.0	13.0			250	240		440	330	400	2.71	
B								0.16	0.24	0.61	27.0	12.0			250	250		440	330	400	2.70	
B								0.13	0.24	0.64	27.0	13.0			250	250		450	340	400	2.71	
B								0.16	0.24	0.62	25.0	13.0			250	250		440	340	400	2.73	
B								0.22	0.23	0.60	27.0	13.0			260	250		450	340	300	2.70	
B								0.14	0.23	0.68	27.0	12.0			260	250		450	330	300	2.72	
B								0.20	0.23	0.57	27.0	13.0			250	250		440	340	400	2.80	
B								0.14	0.24	0.69	26.0	12.0			250	240		450	330	400	2.72	
C								0.10	0.23	0.62	23.3	12.6		1390	1400	255	251	250	431	367	420	2.60
C								0.09	0.20	0.56	22.7	12.4		1360	1400	248	244	250	416	356	420	2.67
C								0.11	0.23	0.61	23.5	12.9		1380	1390	250	251	250	423	364	430	2.73
C								0.09	0.21	0.55	22.8	12.2		1390	1405	249	245	250	418	357	420	2.66
C								0.09	0.22	0.60	23.8	12.8		1380	1400	253	256	250	422	376	420	2.73
C								0.09	0.22	0.63	23.7	12.7		1390	1400	252	254	250	426	373	420	2.62
C								0.08	0.20	0.53	22.8	13.0		1350	1395	247	257	250	414	378	420	2.74
C								0.08	0.21	0.55	23.2	12.8		1360	1390	246	248	250	412	361	420	2.72
E								0.09	0.21	0.53												
E								0.09	0.21	0.51												
E								0.09	0.21	0.54												
E								0.09	0.22	0.58												
E								0.09	0.22	0.57												
E								0.09	0.22	0.54												
E								0.08	0.20	0.54												
E								0.08	0.20	0.52												
F								0.08	0.20	0.47	29.0	14.0			241	278	300	554	554	374		
F								0.08	0.20	0.49	27.0	15.0			286	286	300	578	578	387		
F								0.08	0.20	0.51	30.0	14.0			251	273	200	559	559	372		
F								0.08	0.20	0.49	26.0	13.0			278	258	300	596	596	367		
F								0.08	0.19	0.51	29.0	14.0			249	269	300	553	553	371		
F								0.07	0.20	0.54	27.0	12.0			276	235	300	525	525	324		
F								0.08	0.20	0.54	28.0	14.0			223	270	300	522	522	371		
F								0.08	0.20	0.55	28.0	15.0			260	273	300	525	525	370		

Assay data (cont)

Lab Code	Au NIS g/t	Ir NIS g/t	Pd NIS g/t	Pt NIS g/t	Rh NIS g/t	Ru NIS g/t	Au Pb Col g/t	Pd Pb Col g/t	Pt Pb Col g/t	Co M/ICP ppm	Co P ppm	Co XRF ppm	Cr M/ICP ppm	Cr XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG	
G							0.09	0.23	0.69	21.0	12.0		1265		260	260		439	363		2.81	
G							0.08	0.23	0.68	21.0	12.0		1200		250	259		426	364		2.82	
G							0.10	0.24	0.73	21.0	13.0		1220		251	265		428	371		2.82	
G							0.10	0.24	0.76	22.0	13.0		1250		260	260		443	364		2.82	
G							0.09	0.24	0.71	21.0	13.0		1270		261	260		439	370		2.82	
G							0.10	0.24	0.70	23.0	12.0		1240		263	262		450	358		2.82	
G							0.09	0.23	0.58	22.0	13.0		1275		260	258		443	365		2.81	
G							0.08	0.23	0.62	22.0	13.0		1265		258	260		440	371		2.80	
H	0.09	0.01	0.23	0.71	0.03	0.06	0.10	0.23	0.58	23.9	15.1			1654	231	252	261	427	369	444	2.77	
H	0.06	0.01	0.24	0.63	0.03	0.06	0.09	0.22	0.56	23.1	13.6			1632	238	249	262	421	369	449	2.77	
H	0.07	0.01	0.24	0.63	0.03	0.06	0.10	0.23	0.60	23.4	13.5			1623	233	248	275	430	369	442	2.77	
H	0.08	0.01	0.24	0.76	0.03	0.06	0.10	0.22	0.59	23.5	12.8			1620	245	252	263	429	369	447	2.76	
H	0.07	0.01	0.24	0.64	0.03	0.06	0.09	0.23	0.59	23.1	11.6			1643	236	250	262	429	371	442	2.76	
H	0.07	0.01	0.24	0.66	0.03	0.06	0.09	0.22	0.56	24.9	13.1			1645	231	251	255	427	367	442	2.76	
H	0.07	0.01	0.24	0.67	0.03	0.06	0.10	0.23	0.63	24.3	12.9			1626	228	249	255	433	368	460	2.75	
H	0.07	0.01	0.24	0.62	0.03	0.07	0.09	0.23	0.53	23.2	12.4			1641	233	252	268	428	371	449	2.75	
I							0.09	0.21	0.56	30.0	17.0				261	252		390	352			
I							0.09	0.19	0.57	29.0	17.0				264	250		402	358			
I							0.09	0.21	0.59	28.0	17.0				262	243		391	347			
I							0.09	0.21	0.56	29.0	17.0				271	254		396	363			
I							0.09	0.20	0.55	30.0	17.0				269	249		398	358			
I							0.10	0.21	0.58	30.0	15.0				271	251		402	359			
I							0.09	0.20	0.56	30.0	16.0				267	249		394	358			
I							0.09	0.19	0.56	30.0	18.0				264	252		397	370			
J	0.09		0.21	0.56	0.03	0.06				22.0					273			456				
J	0.08		0.20	0.51	0.03	0.05				19.0					269			465				
J	0.09		0.19	0.51	0.03	0.05				27.0					271			461				
J	0.08		0.21	0.60	0.03	0.06				23.0					269			543				
J	0.08		0.21	0.59	0.02	0.08				27.5					275			530				
J	0.08		0.22	0.58	0.02	0.07				22.5					268			539				
J	0.08		0.21	0.56	0.02	0.07				22.5					276			498				
J	0.09		0.20	0.58	0.03	0.07				23.0					280			499				
K							0.10	0.24	0.60	25.4	12.6		1111		260	257		466	338			
K							0.08	0.24	0.62	24.7	12.8				255	250		462	341			
K							0.09	0.24	0.62	24.9	12.7				1167	254	257		463	345		
K							0.09	0.24	0.57	24.0	13.2				1123	255	246		455	339		
K							0.09	0.24	0.62	25.0	12.4				1083	257	255		463	341		
K							0.10	0.24	0.64	24.4	12.8				1131	253	254		454	339		
K							0.10	0.23	0.62	24.4	12.5				1177	262	251		460	338		
K							0.08	0.23	0.64	23.4	12.7				1159	258	255		458	335		
L	0.10	0.01	0.24	0.58	0.03	0.06				23.0	13.0				248	253		430	399			
L	0.10	0.01	0.24	0.59	0.03	0.06				22.0	13.0				246	254		430	403			
L	0.09	0.01	0.24	0.53	0.03	0.06				22.0	13.0				250	257		427	419			
L	0.10	0.01	0.24	0.54	0.03	0.06				22.0	13.0				250	267		434	409			
L	0.10	0.01	0.24	0.54	0.03	0.06				22.0	13.0				252	265		435	406			
L	0.09	0.01	0.24	0.51	0.03	0.06				22.0	13.0				247	262		428	400			
L	0.10	0.01	0.24	0.56	0.03	0.06				22.0	14.0				250	262		427	405			
L	0.09	0.01	0.25	0.55	0.03	0.06				23.0	14.0				248	262		432	409			
M							0.09	0.23	0.60	28.0	13.0				272	251		479	353			
M							0.10	0.24	0.62	28.0	13.0				275	256		484	358			
M							0.08	0.23	0.57	28.0	13.0				279	258		489	355			
M							0.09	0.24	0.58	26.0	13.0				280	251		505	350			
M							0.10	0.23	0.60	28.0	13.0				276	256		488	355			
M							0.10	0.23	0.59	27.0	13.0				274	252		480	352			
M							0.09	0.24	0.60	27.0	13.0				270	250		481	350			
M							0.09	0.23	0.56	27.0	13.0				274	251		488	349			
N							0.11	0.25	0.61	22.7	14.6				252	250		444	388			
N							0.10	0.24	0.64	23.4	14.8				253	251		448	376			
N							0.10	0.24	0.61	23.6	15.0				253	246		442	376			
N							0.10	0.24	0.59	24.3	14.4				252	243		441	364			
N							0.09	0.25	0.61	23.6	15.9				253	258		440	377			
N							0.10	0.25	0.59	24.1	15.6				252	245		443	370			
N							0.10	0.25	0.61	23.6	14.8				253	247		448	367			
N							0.11	0.26	0.63	23.4	14.2				251	246		438	377			
O	0.08	0.02	0.24	0.60	0.05	0.07	0.08			0.46	19.0	12.2			1806	249	253	239	452	387	403	2.75
O	0.07	0.01	0.18	0.53	0.03	0.05	0.07			0.43	19.0	11.1			1803	261	233	242	453	363	404	2.77
O	0.09	0.01	0.19	0.54	0.03	0.06	0.09			0.56	13.0	12.2			1841	247	229	243	470	357	405	2.75
O	0.08	0.02	0.23	0.56	0.05	0.07	0.08			0.45	19.0	12.2			1819	254	235	242	465	368	402	2.75
O	0.08	0.01	0.20	0.54	0.03	0.05	0.08			0.55	21.0	12.2			1781	252	243	242	438	370	406	2.76
O	0.10	0.01	0.20	0.58	0.05	0.05	0.09			0.52	20.0	11.1			1796	262	242	240	450	372	400	2.75
O	0.07	0.01	0.21	0.60	0.03	0.06	0.07			0.43	21.0	11.1			1802	253	237	241	470	356	408	2.76
O	0.09	0.01	0.25	0.61	0.05	0.07	0.09			0.55	20.0	12.2			1772	257	239	244	456	357	412	2.75
P							0.03			0.21	0.56							242			456	2.86
P							0.03			0.21	0.62							261			485	
P							0.04			0.25	0.72							245			444	
P							0.03			0.21	0.56							242			430	2.87
P							0.03			0.20	0.61							234			431	2.82
P							0.03			0.21	0.57							250			439	2.83
P							0.03			0.20	0.62							243			424	2.87
P							0.03			0.21	0.57							282			456	2.86

Assay data (cont)

Lab Code	Au NIS g/t	Ir NIS g/t	Pd NIS g/t	Pt NIS g/t	Rh NiS g/t	Ru NIS g/t	Au Pb Col g/t	Pd Pb Col g/t	Pt Pb Col g/t	Co M/ICP ppm	Co P ppm	Co XRF ppm	Cr M/ICP ppm	Cr XRF ppm	Cu M/ICP ppm	Cu P ppm	Cu XRF ppm	Ni M/ICP ppm	Ni P ppm	Ni XRF ppm	SG	
R	0.08	0.01	0.22	0.57	0.03	0.05	0.08	0.20	0.55	23.0	12.0			1556	252	227	248	439	354	456	2.95	
R	0.10	0.01	0.21	0.56	0.03	0.06	0.08	0.19	0.51	24.0	12.0			1577	251	219	261	448	341	444	2.88	
R	0.08	0.01	0.22	0.52	0.03	0.05	0.09	0.20	0.54	24.0	12.0			1579	250	232	264	446	360	456	2.89	
R	0.08	0.01	0.23	0.62	0.03	0.06	0.07	0.19	0.57	24.0	12.0			1561	252	235	253	449	348	464	2.99	
R	0.10	0.01	0.23	0.58	0.03	0.06	0.09	0.20	0.57	24.0	12.0			1575	253	243	249	447	361	464	2.90	
R	0.08	0.01	0.22	0.54	0.03	0.06	0.08	0.20	0.55	24.0	13.0			1699	252	241	246	450	353	430	2.88	
R	0.11	0.01	0.23	0.66	0.03	0.06	0.10	0.21	0.58	26.0	12.0			1549	249	244	256	443	363	458	2.87	
R	0.09	0.01	0.23	0.54	0.03	0.06	0.07	0.18	0.48	23.0	12.0			1564	251	239	250	447	357	461	2.84	
T								0.11	0.23	0.58	20.0									408		
T								0.09	0.23	0.60	20.0									379		
T								0.09	0.24	0.61	19.0									390		
T								0.09	0.24	0.61	20.0									401		
T								0.10	0.24	0.61	18.0									391		
T								0.09	0.25	0.63	19.0									385		
T								0.10	0.25	0.64	19.0									387		
T								0.08	0.23	0.58	20.0									379		
U								0.07	0.24	0.60												
U								0.09	0.24	0.58												
U								0.08	0.22	0.59												
U								0.10	0.25	0.63												
U								0.10	0.22	0.61												
U								0.09	0.23	0.59												
U								0.09	0.21	0.63												
U								0.08	0.24	0.59												
Z	0.09	0.01	0.24	0.57	0.03	0.05	0.10	0.23	0.63	25.0	12.0				252	251		458	358		2.81	
Z	0.09	0.01	0.23	0.62	0.03	0.06	0.09	0.22	0.66	25.0	12.0				256	251		454	354		2.83	
Z	0.09	0.01	0.23	0.54	0.03	0.05	0.08	0.19	0.53	25.0	14.0				258	255		458	370		2.84	
Z	0.11	0.01	0.19	0.54	0.03	0.05	0.08	0.21	0.61	25.0	12.0				256	255		460	364		2.83	
Z	0.10	0.01	0.21	0.58	0.03	0.05	0.09	0.21	0.56	25.0	12.0				262	257		462	370		2.83	
Z	0.10	0.01	0.22	0.54	0.03	0.06	0.09	0.21	0.56	25.0	12.0				260	257		460	372		2.84	
Z	0.10	0.01	0.22	0.54	0.03	0.06	0.10	0.23	0.61	25.0	12.0				260	259		468	368		2.83	
Z	0.10	0.01	0.23	0.60	0.03	0.06	0.09	0.22	0.60	25.0	12.0				260	258		462	370		2.81	
ZB	0.09		0.24	0.61	0.03	0.07	0.08	0.24	0.61	23.0	20.0	30.0		1738	240	240		460	390	397	2.77	
ZB	0.09		0.23	0.61	0.03	0.05	0.09	0.24	0.59	22.0	20.0	26.0		1800	240	230		460	390	397	2.76	
ZB	0.08		0.25	0.59	0.04	0.06	0.08	0.24	0.60	22.0	20.0	29.0		1779	250	230		470	390	398	2.70	
ZB	0.08		0.24	0.62	0.03	0.06	0.09	0.23	0.60	23.0	20.0	27.0		1897	240	230		460	390	399	2.74	
ZB	0.09		0.24	0.61	0.04	0.08	0.09	0.24	0.61	22.0	20.0	27.0		1882	240	230		470	380	398	2.74	
ZB	0.09		0.24	0.62	0.05	0.06	0.09	0.24	0.60	22.0	20.0	32.0		1704	250	240		460	390	402	2.75	
ZB	0.09		0.24	0.60	0.04	0.06	0.09	0.23	0.62	23.0	20.0	24.0		1746	250	230		470	380	394	2.74	
ZB	0.09		0.25	0.60	0.04	0.06	0.09	0.23	0.61	22.0	20.0	28.0		1742	250	240		470	380	399	2.76	
ZC	0.09	0.01										25.0		1710							440	
ZC	0.10	0.01										24.0		1690							430	
ZC	0.09	0.01										25.0		1720							440	
ZC	0.10	0.01										24.0		1690							430	
ZC	0.12	0.01										23.0		1650							430	
ZC	0.09	0.01										24.0		1660							430	
ZC	0.09	0.01										25.0		1680							430	
ZC	0.09	0.01										24.0		1650							430	
ZD								0.08	0.23	0.60	21.0	13.0			225	249		391	356		2.67	
ZD								0.08	0.21	0.52	21.0	13.0			223	250		385	355		2.70	
ZD								0.09	0.20	0.52	21.0	13.0			225	255		388	361		2.68	
ZD								0.10	0.24	0.64	21.0	13.0			228	250		397	356		2.68	
ZD								0.10	0.22	0.62	21.0	13.0			232	254		401	358		2.68	
ZD								0.08	0.20	0.53	21.0	12.0			228	248		395	355		2.69	
ZD								0.09	0.23	0.61	24.0	12.0			250	245		431	347		2.68	
ZD								0.11	0.21	0.56	23.0	13.0			243	254		421	357		2.70	
ZE		0.01	0.21	0.55	0.03	0.06	0.09	0.23	0.64													
ZE		0.01	0.22	0.56	0.03	0.06	0.09	0.23	0.60													
ZE		0.01	0.23	0.58	0.03	0.07	0.09	0.24	0.63													
ZE		0.01	0.24	0.58	0.03	0.07	0.09	0.24	0.60													
ZE		0.01	0.22	0.55	0.03	0.07	0.09	0.24	0.62													
ZE		0.01	0.24	0.55	0.03	0.07	0.09	0.24	0.57													
ZE		0.01	0.23	0.55	0.03	0.06	0.08	0.25	0.65													
ZE		0.01	0.22	0.57	0.03	0.06	0.08	0.23	0.61													

12. Measurement of Uncertainty:

The samples used in this certification process have been selected in such a way as to represent the entire batch of material and were taken from the final packaged units; therefore all possible sources of uncertainty (sample uncertainty and measurement uncertainty) are included in the final combined standard uncertainty determination. The uncertainty measurement takes into consideration the between lab and the within lab variances and is calculated from the square roots of the variances of these components using the formula:

$$\text{Combined standard uncertainty} = \sqrt{(\text{between lab.var/no of labs}) + (\text{mean square within lab.var/no of assays})}$$

These uncertainty measurements may be used by laboratories as a component for calculating the total uncertainty for method validation according to ISO guidelines.

Analyte	Method	CSU*	Unit	Analyte	Method	CSU*	Unit	Analyte	Method	CSU*	Unit
Au	NIS	0.004	ppm	Cr	M/ICP	109.395	ppm	Cr2O3	XRF	0.002	%
Ir	NiS	0.0002	ppm	Cr	XRF	88.982	ppm	Fe2O3	XRF	0.0142	%
Pd	NIS	0.006	ppm	Cu	M/ICP	1.477	ppm	K2O	XRF	0.001	%
Pt	NIS	0.005	ppm	Cu	P	1.476	ppm	LOI	XRF	0.019	%
Rh	NiS	0.0004	ppm	Cu	XRF	5.295	ppm	MgO	XRF	0.035	%
Ru	NiS	0.001	ppm	Ni	M/ICP	4.415	ppm	MnO	XRF	0.0003	%
Au	Pb Col	0.001	ppm	Ni	P	2.518	ppm	Na2O	XRF	0.009	%
Pd	Pb Col	0.003	ppm	Ni	XRF	10.821	ppm	P2O5	XRF	0.002	%
Pt	Pb Col	0.005	ppm	SG		0.022		S	ICP	0.005	%
Co	M/ICP	0.398	ppm	Al2O3	XRF	0.007	%	SiO2	XRF	0.070	%
Co	P	0.133	ppm	CaO	XRF	0.007	%	TiO2	XRF	0.002	%

*CSU = Combined standard uncertainty

13. Uncertified values: The Certified, Provisional and Indicated values listed on p1 and p2 of this certificate fulfill the AMIS statistical criteria regarding agreement for certification and have been independently validated by Dr Barry Smee.

14. Metrological Traceability: The values quoted herein are based on the consensus values derived from statistical analysis of the data from an inter laboratory measurement program. Traceability to SI units is via the standards used by the individual laboratories the majority of which are accredited and who have maintained measurement traceability during the analytical process.

15. Certification: AMIS0099 is a new material.

16. Period of validity: The certified values are valid for this product, while still sealed in its original packaging, until notification to the contrary. The stability of the material will be subject to continuous testing for the duration of the inventory. Should product stability become an issue, all customers will be notified and notification to that effect will be placed on the www.amis.co.za website.

17. Minimum sample size: The majority of laboratories reporting used a 0.5g sample size for the ICP and a 30g sample size for the fire assay. These are the recommended minimum sample sizes for the use of this material.

18. Availability: This product is available in Laboratory Packs containing 1kg of material and Explorer Packs containing custom weights (from 50 to 250g) of material. The Laboratory Packs are sealed bottles delivered in sealed foil pouches. The Explorer Packs contain material in standard geochem envelopes, nitrogen flushed and vacuum sealed in foil pouches.

19. Legal Notice: This certificate and the reference material described in it have been prepared with due care and attention. However AMIS, Set Point Technology (Pty) Ltd, Mike McWha, Dr Barry Smee and Smee and Associates Ltd; accept no liability for any decisions or actions taken following the use of the reference material.

29 July 2009

Certifying Officers:



African Mineral Standards: _____

Mike McWha
BSc (Hons), FGSSA, MAusIMM, Pr.Sci.Nat



Geochemist: _____

Barry W. Smee
BSc, PhD, P.Geo, (B.C.)

Appendix – uncertified trace element statistics

AMIS0099 Trace

Analyte	Method	Unit	Mean	2SD	RSD%	n
Mn	M/ICP	ppm	917	64	3.5	24
Zn	M/ICP	ppm	54.6	9.6	8.8	23
P	M/ICP	%	42.9	63.1	73.5	24
V	M/ICP	ppm	30.8	1.5	2.5	32
Sr	M/ICP	ppm	27.2	3.1	5.8	22
Ba	M/ICP	ppm	22.1	4.6	10.3	30
Zr	M/ICP	ppm	21.8	4.0	9.2	23
Ce	M/ICP	ppm	6.64	1.3	9.8	24
Pb	M/ICP	ppm	4.66	1.3	13.9	29
Sc	M/ICP	ppm	4.55	1.2	13.1	32
Rb	M/ICP	ppm	4.04	0.6	7.2	24
As	M/ICP	ppm	3.42	7.0	102.2	17
La	M/ICP	ppm	3.29	0.4	6.7	24
Nd	M/ICP	ppm	2.78	0.2	4.3	8
Mo	M/ICP	ppm	2.63	0.8	14.3	32
Sb	M/ICP	ppm	2.47	0.7	14.9	23
Ga	M/ICP	ppm	2.46	0.1	2.3	14
Y	M/ICP	ppm	2.35	0.4	7.8	24
Fe	M/ICP	ppm	2.24	0.2	3.5	24
Mg	M/ICP	ppm	2.00	0.1	3.2	24
Th	M/ICP	ppm	1.55	0.3	9.0	24
Sn	M/ICP	ppm	1.53	1.0	32.7	24
Li	M/ICP	ppm	1.25	0.4	15.0	14
Al	M/ICP	ppm	1.12	0.1	2.9	23
U	M/ICP	ppm	0.79	0.2	10.3	23
Ca	M/ICP	ppm	0.77	0.0	2.6	24
Pr	M/ICP	ppm	0.73	0.1	4.8	8
Hf	M/ICP	ppm	0.70	0.2	10.8	22
Nb	M/ICP	ppm	0.63	0.1	7.9	17
Ge	M/ICP	ppm	0.52	0.9	90.6	16
Dy	M/ICP	ppm	0.49	0.1	14.8	8
Gd	M/ICP	ppm	0.49	0.2	21.5	8
W	M/ICP	ppm	0.48	0.4	44.1	18
Sm	M/ICP	ppm	0.40	0.1	17.9	8
Er	M/ICP	ppm	0.32	0.10	15.6	8
Yb	M/ICP	ppm	0.27	0.08	14.5	7
Cs	M/ICP	ppm	0.17	0.03	10.0	16
Te	M/ICP	ppm	0.14	0.01	5.0	8
Na	M/ICP	ppm	0.12	0.06	23.3	24
Ag	M/ICP	ppm	0.11	0.02	10.6	15
K	M/ICP	ppm	0.11	0.03	11.9	24
Bi	M/ICP	ppm	0.10	0.00	0.0	12
Eu	M/ICP	ppm	0.10	0.04	21.5	8
Be	M/ICP	ppm	0.09	0.02	9.4	8
Ho	M/ICP	ppm	0.08	0.02	10.9	8
Tb	M/ICP	ppm	0.08	0.01	4.8	7
Cd	M/ICP	ppm	0.08	0.14	88.4	14
Ta	M/ICP	ppm	0.06	0.01	8.3	7
Tm	M/ICP	ppm	0.06	0.02	15.4	7
Ti	M/ICP	ppm	0.04	0.01	10.6	32
Tl	M/ICP	ppm	0.04	0.01	15.3	8
In	M/ICP	ppm	0.008	0.001	7.1	8